NASA TECHNICAL MEMORANDUM

NASA TM X-53378

January 13, 1966

NASA TM X-53378

1965 PUBLICATIONS

By
Materials Division

NASA

George C. Marshall Space Flight Center, Huntsville, Alabama

NASA-GEORGE C. MARSHALL SPACE FLIGHT CENTER

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MATERIALS DIVISION
PROPULSION AND VEHICLE ENGINEERING LABORATORY

NASA-GEORGE C. MARSHALL SPACE FLIGHT CENTER

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ABSTRACT

"1965 Publications" is a compilation of abstracts of NASA Technical Memorandums and MSFC Internal Notes, written by personnel of the Materials Division and released during 1965.

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GEORGE C. MARSHALL SPACE FLIGHT CENTER

TECHNICAL MEMORANDUM X-53378

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SUMMARY

This report lists and abstracts NASA Technical Memorandums and MSFC Internal Notes written by personnel of the Materials Division, Propulsion and Vehicle Engineering Laboratory, George C. Marshall Space Flight Center, National Aeronautics and Space Administration, during 1965.

INTRODUCTION

The mission of the Materials Division is to conduct research and development in materials science and engineering as related to the programs of the George C. Marshall Space Flight Center. This report lists and abstracts the technical reports written by personnel of the Materials Division during 1965.

Requests for copies of these reports should be addressed to:

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Huntsville, Alabama 35812
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January 30, 1965 1964 PUBLICATIONS NASA TM X-53191

by Materials Division

Unclassified, 18 pages

"1964 Publications" is a compilation of abstracts of a NASA Technical Note, NASA Technical Memorandums, and MSFC Internal Notes, written by personnel of the Materials Division and released during 1964.

January 20, 1965 SPECTROGRAPHIC SOLUTION ANALYSIS OF ALUMINUM ALLOYS NASA TM X-53192

by D. Hamilton and S. Corbitt

Unclassified, 18 pages, 5 tables, 6 figures, 1 plate

To obtain accurate analyses of metals and alloys with the most widely used technique of spectrographic analysis,i.e., the point-to-plane spark technique, the standards and the unknown material must be quite similar in size, shape, chemical composition, and metallurgical state. By dissolving the sample and using the vacuum cup spark technique to analyze the solution, these limitations can be circumvented. Standards can be synthesized easily by mixing aliquots of master reference solutions. The solution technique also offers the possibility of adding an internal standard and, thereby, obtaining a wider selection of reference lines to use in the analysis.

The solution spectrographic method has been investigated and applied to a wide variety of analytical problems at this Center. As an example, the procedure for the determination of manganese, zirconium, magnesium, vanadium, titanium, and iron in types 2219 and 2319 aluminum alloy is presented. The results agree with the results of classical wet methods and are precise to ±0.005 percent in the concentration ranges involved.

January 22, 1965 NONMONOTONICITY IN SENSITIVITY TEST DATA NASA TM X-53194

by J. B. GAYLE

Unclassified, 9 pages, 2 figures

In general, the frequency of reactions for sensitivity test data of the "go-no-go" type increases monotonically with increasing levels of stimulus. However, occasional instances of nonmonotonic behavior have been noted.

One such instance has been investigated by carrying out a sufficient number of replicate tests to permit a statistical analysis of the data. The results indicated that over a considerable range of stimulus levels the frequency of response decreased significantly with increasing stimulus levels. The significance of this finding to sensitivity testing in general is discussed.

February 1, 1965 STUDIES IN SILAZANE CHEMISTRY NASA TM X-53197

by James D. Byrd and James E. Curry

Unclassified, 31 pages, 6 tables, 7 figures

The chemistry of a number of silazane compounds has been studied in an effort to prepare polymers containing Si-N linkages. This effort has resulted in the discovery or development of some new and interesting polymeric materials.

Polysilazanes having good thermal stability, elastomeric properties, and good film-forming properties have been prepared. A method has been developed for the preparation of an elastomeric silazane from dimethyldichlorosilane and ethylenediamine. This material has good thermal stability and remains rubbery after extended exposure to elevated temperatures (300-400°C).

Polymers having a number of useful properties were prepared by the polymerization of equimolar amounts of hexaphenylcyclotrisilazane and a number of different aromatic diols such as p, p'-biphenol.

February 5, 1965 VACUUM COMPATIBILITY OF ENGINEERING MATERIALS (LIQUIDS AND SEMI-SOLIDS) NASA TM X-53207

by J. G. Austin and J. B. Gayle

Unclassified, 34 pages, 25 figures

The rates of evaporation of 20 liquid and semi-solid materials in a vacuum environment and the effects of temperature on the rates of evaporation of 11 of the 20 materials were determined experimentally. Test conditions were from room temperature to 154°C at pressures of 10^{-5} torr or less.

February 15, 1965 EFFECT OF LIQUID NITROGEN DILUTION ON LOX IMPACT SENSITIVITY NASA TM X-53208

by C. F. Key and J. B. Gayle

Unclassified, 26 pages, 18 figures

An experimental investigation was carried out to study the decrease in reactivity of materials with liquid oxygen (LOX) that is caused by dilution of the LOX with liquid nitrogen (LN_2). A wide range of materials was selected for testing, each of which previously had been shown to be sensitive to impact in LOX. Tests were made with the ABMA LOX Impact Tester using LOX/LN_2 mixtures ranging in concentration from 20 percent LOX in LN_2 to pure LOX. The results showed that relatively large proportions of LN_2 were required to effect an appreciable decrease in reactivity; however, all materials tested were insensitive to impact at 10 kg-m in liquid air.

March 17, 1965 ACOUSTIC TECHNIQUES FOR THE NONDESTRUCTIVE EVALUATION OF ADHESIVELY BONDED COMPOSITE MATERIALS NASA TM X-53219

by W. N. Clotfelter

Unclassified, 43 pages, 27 figures

The extensive usage of composite materials in the Saturn vehicle has required considerable effort in the development of nondestructive inspection methods to evaluate the mechanical integrity of these materials. This report describes through-transmission and single-side acoustic methods applicable to the quality verification of composite panels. Some of the techniques discussed are "off the shelf." Others are believed to be unique. All of these inspection methods are discussed and illustrated to show their applicability to the quality verification of certain types of composite structure used in the Saturn. An attempt has been made to relate selected techniques to the acoustic characteristics of the materials used.

March 18, 1965 H-1 ENGINE LOX DOME FAILURE NASA TM X-53220

by C. E. Cataldo

Unclassified, 22 pages, 6 tables, 9 figures

A 7079-T6 aluminum forging, which is the forward closure of the H-1 rocket engine combustion chamber, failed after the engine was installed on the Saturn S-I-7 vehicle. It was concluded that the failure, occurring several weeks before launch at the Kennedy Space Center, was caused by stress corrosion. This report describes the metallurgical analysis of the failure and discusses previous failures experienced on this same part and the corrective actions that were taken.

March 26, 1965 COMPARISON OF TWO INSTRUMENTS FOR DETERMINING HARDNESS OF ELASTOMERS NASA TM X-53226

by J. T. Schell and C. D. Hooper

Unclassified, 31 pages, 5 tables, 18 figures

To reach a higher degree of accuracy in control evaluations of rubber compounds, a comparison was made of two commercially available instruments for measuring hardness of elastomeric compounds. These instruments, the Shore durometer and ASTM (Tinius Olsen), were compared over a wide hardness range on 13 types of rubber formulations.

Studies indicated that, although the ASTM (Tinius Olsen) instrument requires a more refined test specimen and is somewhat more difficult to operate, it is a more precise instrument and should be used where very close tolerances are involved or as a "referee" in case of doubt with other instruments. The Shore durometer provides a rapid means for measuring hardness of elastomers; the specimen size is not critical; and the Shore durometer accuracy is sufficient for control evaluations as well as for the majority of end items.

With the graphs and tables in this report, it is possible to convert units of measure from one instrument to the other for a particular compound of interest; however, to prepare a single table (or graph) illustrating a "typical" correlation for all elastomers is not practical because of the variation in creep with different formulations.

March 30, 1965 EFFECTS OF NUCLEAR RADIATION, CRYOGENIC TEMPERATURE, AND VACUUM ON THE ELECTRICAL PROPERTIES OF DIELECTRIC MATERIALS NASA TM X-53230

by R. L. Gause and E. C. McKannan

Unclassified, 29 pages, 6 tables, 11 figures

The dielectric properties of polymeric materials probably are among the most sensitive to the effects of radiation from the space environment, from nuclear power sources, or from nuclear rockets. These properties also are affected in various ways by other parameters of the space environment such as vacuum and temperature. Therefore, a combined environmental evaluation of four commonly used dielectrics was made. Some preliminary results indicate that the effect on the dielectric constant and dissipation factor of the polymers was minor for vacuum alone but of major significance for radiation alone. The cryogenic tempemperatures had

a minor effect on the dielectric properties of silicone rubber and polytetrafluoroethylene but a direct and significant effect on the epoxy and polyurethane materials. It appeared that the effect of cryogenic temperatures may have counteracted the radiation effects in some cases. Obtaining dielectric measurements within the combined environmental simulator posed some special problems and required some novel techniques which are described.

April 2, 1965 ACCELERATED COMPRESSION SET PROPERTIES OF FOURTEEN ELASTOMERS NASA TM X-53232

by C. D. Hooper and J. T. Schell

Unclassified, 44 pages, 35 figures

Fourteen types of synthetic elastomers, from which O-rings and other gaskets might be fabricated, were investigated for their compression set properties. Each compound was tested at a minimum of three temperatures (ranging from 70°C (158°F) to 250°C (482°F)) during various periods of time up to 32 days.

Results showed that most elastomers have reasonably good compression set properties at room temperature (25°C) but that many of these might have critical limitations when subjected to the same compression at an elevated temperature. These tests, like other accelerated tests, were not expected to indicate the small differences that might be encountered in actual service; however, they do provide a practical evaluation of the properties that are useful where a high degree of precision is not expected.

A summary of the data obtained from this study is presented in graphical form, illustrating the characteristics and limitations of each compound tested.

April 9, 1965 PRELIMINARY INVESTIGATION OF BLAST HAZARDS OF RP-1/LOX AND LH_2/LOX PROPELLANT COMBINATIONS NASA TM X-53240

by John B. Gayle, Charles H. Blakewood, James W. Bransford, William H. Swindell, and Richard W. High

Unclassified, 31 pages, 20 figures

This report discusses the current status of information regarding the blast hazards of liquid propellants and presents results obtained from one part of a comprehensive analytical and experimental investigation of this problem. The data generally were consistent with siting

criteria now used for RP-1/LOX. However, explosive yields determined for LH_2/LOX were markedly lower than values reported by previous investigators and suggest that current siting criteria for this propellant combination may be overly conservative.

May 25, 1965 FURTHER DEVELOPMENT AND EVALUATION OF M-31 INSULATION FOR RADIANT HEATING ENVIRONMENTS NASA TM X-53267

by Vaughn F. Seitzinger

Unclassified, 25 pages, 4 tables, 6 figures

The results of a program for additional development and evaluation of M-31 insulation, a composite material developed specifically to protect the base of the Saturn launch vehicle, are presented. This insulation is comprised of fibrous potassium titanate and asbestos fibers, bonded with colloidal silica. Processing techniques by the manufacturer of potassium titanate resulted in an increase in the bulk density, thermal conductivity, mechanical strength, and drying shrinkage of the insulation.

June 21, 1965 AUTOMATIC EXTENSOMETER FOR ELASTOMERS NASA TM X-53231

by C. D. Hooper

Unclassified, 19 pages, 1 table 11 figures

An extensometer has been designed to measure accurately the elongation of any elastomer or similar material and to record electronically this data on the chart of the testing instrument. This instrument, which may be used by operators with a minimum of experience, results in reproducibility of data from laboratory to laboratory since the extension is measured by a semi-automatic process.

Although it was designed for accuracy (from 0 to 1000 percent using a one-inch original gauge), the instrument is rugged enough to require no special handling. It is relatively simple to fabricate in a standard machine shop and can be adapted to almost any tension testing instrument (conforming to ASTM or Military Specifications for testing elastomers) at a very low cost when compared to other commercial laboratory equipment.

June 24, 1965 VACUUM COMPATIBILITY OF ENGINEERING MATERIALS (SOLIDS) II NASA TM X-53286

by J. G. Austin and J. B. Gayle

Unclassified, 156 pages, 2 tables, 130 figures

The rate and extent of weight loss of 62 solid materials in a vacuum environment were determined experimentally by continuous and intermittent weighing techniques. Test conditions ranged from 41°C to 200°C at pressures of 10^{-2} to 10^{-5} torr. The results are presented in 2 tables and 130 figures.

July 23, 1965 LOW TEMPERATURE MECHANICAL PROPERTIES OF HP 9-4-25 ALLOY NASA TM X-53302

by W. R. Morgan

Unclassified, 13 pages, 3 tables, 4 figures

The mechanical properties of HP 9-4-25 alloy sheet (0.062-inch thick) were determined at temperatures from 27°C (80°F) to -253°C (-423°F). The ultimate tensile and yield strengths were considerably greater at -253°C (-423°F) than at 27°C (80°F), and the notched/unnotched tensile ratios were greater than 0.81 at temperatures from 27°C (80°F) to -196°C (-320°F). This alloy is not recommended for critical applications below -196°C (-320°F) since the elongation and notched/unnotched tensile ratio decreased rapidly below this temperature.

August 4, 1965 SIZE AND DURATION OF FIREBALLS FROM PROPELLANT EXPLOSIONS NASA TM X-53314

by J. B. Gayle and J. W. Bransford

Unclassified, 19 pages, 7 figures

Data from tests and vehicle incidents have been compiled and analyzed with respect to fireball diameters and durations. Both variables were found to be dependent on the cube root of the weight of the combined propellants and independent of the particular propellant combination. Fireball diameters also appear to be roughly dependent on the cube root of the ambient pressures.

August 9, 1965 STRESS CORROSION STUDIES OF AM-355 STAINLESS STEEL NASA TM X-53317

by J. G. Williamson

Unclassified, 18 pages, 3 tables, 6 figures

The stress corrosion cracking susceptibility of AM-355 stainless steel alloy was studied. This alloy is used extensively for sleeves in flared

tube fittings in the S-I and S-IC stages of the Saturn I and Saturn V vehicles, respectively. Various heat treated conditions were investigated and relative stress corrosion cracking susceptibility determined. Of the generally used heat treatments, the fully hardened SCT 1000 treatment was found to be superior in stress corrosion resistance.

September 13, 1965 EXPERIMENTAL X-RAY STRESS ANALYSIS FOR PRECIPITATION HARDENED ALUMINUM ALLOYS NASA TM X-53329

by J. H. Wharton and W. L. Prince

Unclassified, 26 pages, 12 figures

X-ray diffraction techniques for determining stress in precipitation hardened aluminum alloys have been developed and evaluated. The materials investigated included 2014-T6, 2219-T37, and 7075-T6 aluminum alloys. A precision corresponding to ±5 percent of the alloy yield strengths was obtained under laboratory conditions. Further studies are needed to evaluate this method for field measurements of stress in vehicle components.

September 14, 1965 INVESTIGATION OF THE COEFFICIENT OF FRICTION OF VARIOUS GREASES AND DRY FILM LUBRICANTS AT ULTRA HIGH LOADS FOR THE SATURN HOLD DOWN ARMS NASA TM X-53331

by K. E. Demorest and A. F. Whitaker

Unclassified, 29 pages, 2 tables, 12 figures

A series of high load, low speed sliding friction tests was made on 8 fluid lubricants and 18 dry lubricants at normal unit loads from 10,000 psi to 150,000 psi. Four different substrate materials having a range of hardnesses from Rockwell C 18 to Rockwell C 55 were used. The ultimate load capability of both fluids and dry films is a function of substrate hardness with the best ultimate load capability being provided by inorganically bonded molybdenum disulfide films with small amounts of graphite added. The coefficient of friction of the fluid lubricants appears to be an inverse function of substrate hardness and a direct function of the normal load. The coefficient of friction of the dry lubricants is an inverse function of the normal load, but it does not appear to be related to the substrate hardness.

September 14, 1965 LOW TEMPERATURE MECHANICAL PROPERTIES OF ALUMINUM ALLOY 2219-T87, 0.040-INCH THICK SHEET THROUGH 5.000-INCH THICK PLATE NASA TM X-53332

by C. R. Denaburg

Unclassified, 33 pages, 12 tables, 11 figures

The mechanical properties of aluminum alloy 2219-T87 sheet and plate of various thicknesses were determined over the temperature range from ambient through -253°C (-423°F). The ultimate tensile and yield strengths in the longitudinal and transverse direction increased as the temperature decreased. The ultimate tensile strength ranged from 66.4 to 69.4 ksi at ambient temperature and 95.8 to 107.3 ksi at -253°C (-423°F). The yield strength at ambient temperature was between 54.1 and 57.1 ksi; however, at -253°C (-423°F), it ranged between 68.8 and 79.5 ksi.

The elongation, in general, increased as the temperature decreased. Elongation in the longitudinal and transverse directions for all the thicknesses investigated averaged 9.0 percent at ambient temperature and 11 percent at -253°C (-423°F).

The tensile strength in the short transverse direction for the two-inch thick plate was 64.0 ksi at ambient temperature and 78.9 ksi at -253°C (-423°F). The elongation was 4.6 percent at ambient temperature and decreased to 1.3 percent at -253°C (-423°F).

The tensile strength in the short transverse direction of the five-inch thick plate was 54.6 ksi at ambient temperature and 65.1 ksi at -253°C (-423°F). Elongation was 0.6, 0.2, and 1.6 percent in two inches for ambient temperature, -196°C (-320°F), and -253°C (-423°F), respectively.

Previous evaluations of aluminum alloy 2219 by this division are referenced.

November 1, 1965 DISTRIBUTION OF FAILURE TIMES IN STRESS CORROSION TESTS NASA TM X-53355

by J. B. Gayle

Unclassified, 12 pages, 3 figures

The results of stress corrosion tests on aluminum alloys have been analyzed with respect to the statistical nature of the distribution of failure times. The analyses indicated that the data were represented adequately by a three-parameter Weibull distribution in which the induction period amounted to 85 percent of the time of the first observed failure and 55 percent of the time required for failure of half the specimens.

November 3, 1965 EFFECTS OF VARIOUS ADDITIVES ON PHYSICAL PROPERTIES AND PERFORMANCE OF MONOMETHYLHYDRAZINE NASA TM X-53356

by Harold Perkins

Unclassified, 15 pages, 2 tables, 7 figures

The freezing and boiling points of 0 -40 percent mixtures of various nitrogen compounds and water in monomethylhydrazine (MMH) were determined experimentally. The additives for these mixtures were selected on the basis of chemical similarity to MMH, mixture thermal stability, probability of contamination occurrence, cryoscopic and ebullioscopic effects, and anticipated effects on propellant performance.

Theoretical specific impulses were calculated as a function of additive concentration using nominal values of the Saturn S-IVB Vehicle Auxiliary Propulsion System as a basis.

November 4, 1965 SIMULATION STUDY OF THE AMOUNT OF SENSITIVITY TEST DATA REQUIRED TO REJECT THE HYPOTHESIS OF NORMALITY WHEN THE SAMPLE POPULATION IS NONNORMAL — NASA TM X-53357

by J. B. Gayle and C. L. Hopkins

Unclassified, 13 pages, 3 tables, 3 figures

Computer simulation techniques were used to study the number of sensitivity tests which are required to reject the hypothesis of a normally distributed sample population when the population actually was nonnormal. The results indicated that, even under the most favorable conditions, the number of tests required far exceed the number usually run in sensitivity type testing. This suggests that any assumption concerning the statistical nature of the distribution ordinarily will not be verified experimentally.

November 4, 1965 STATUS REPORT ON CHEMICAL SYNTHESIS OF MONOMERIC SELF-SEALANT TYPE ESTERS — NASA TM X-53358

by Lawrence R. Moffett, Jr.

Unclassified, 21 pages, 8 figures

The purpose of this program was to develop an efficient synthetic chemical route or the preparation of alkyl esters of α -cyanosorbic acid (1-cyano-hexadienoic acid) as intermediates in self sealant polymerization studies. The in-house investigation of the direct and indirect esterification of α-cyanosorbic acid, employing standard and non-conventional techniques, has resulted in the development of a satisfactory procedure for the preparation of n-butyl-α-cyanosorbate and n-amyl-α-cyanosorbate in yields approaching 90 percent. Parallel studies which were initiated by the Research and Technology Division of the Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, (ASD) under Government Work Order H-71461, have resulted in the preparation of

n-butyl-α-cyanosorbate in somewhat lower yields with concomitant longer reaction periods. The synthetic procedures developed in both investigations are discussed in detail in this report, and chemical and spectral data are presented to verify the identities of the esters formed in the various reactions.

This program established that the direct esterification of α-cyanosorbic acid is quite feasible and is a much preferred route to the indirect esterification through preparation of such intermediates as the corresponding acid chlorides and sodium salts.

December 15, 1965 A COMPILATION OF RADIANT AND CONVECTIVE HEATING TEST RESULTS NASA TM X-53369

by F. Uptagrafft, L. A. Soileau, and T. Barkley

Unclassified, 104 pages, 12 tables, 5 figures

The report is a compilation of data which characterize the response of approximately 1,500 insulation materials when they are exposed to a variety of temperature and pressure environments. To establish the capability of these materials to satisfy the many conditions to which they could be exposed in the Saturn launch vehicles, a multitude of different heat pulses was included in the material evaluation. The purpose of the program was to define the characteristics of these materials in peculiar environments (e.g., radiant heating, heating at reduced pressure, etc.) which are experienced in the Saturn stages and for which no data were available. The preponderance of the materials evaluated are available commercially.

INTERNAL NOTES

January 4, 1965 FLEXURE FATIGUE PROPERTIES OF TYPICAL S-IV COMMON BULKHEAD COMPOSITE SANDWICH STRUCTURE AT LIQUID NITROGEN TEMPERATURE IN-P&VE-M-65-1

by O. Y. Reece and R. S. Harvey

Unclassified, 12 pages, 1 table, 4 figures

A series of fatigue tests was completed at -196°C (-320°F) in the 0 to 5 million cycles range for the purpose of establishing an S-N curve for a honeycomb structure typical of that used for Saturn S-IV common bulkhead construction. The data and projections show that the average fatigue strength of the panels exceeded the proportional limit in the

range of 0 to 10 million cycles, and the 95 percent confidence limit of the fatigue strength exceeded the proportional limit in the range of 0 to 400;000 cycles.

January 28, 1965 — LOW TEMPERATURE MECHANICAL PROPERTIES OF "TENSILIZED" WASPALOY BOLTS — IN-P&VE-M-65-2

by J. W. Montano

Unclassified, 22 pages, 7 tables, 6 figures

This report presents the mechanical properties of "Tensilized" Waspaloy bolts and reduced shank bolt specimens which were tested at temperatures from ambient to -423°F (-253°C). The mechanical properties of the bolt specimens were compared with those of high strength A-286 alloy. It was concluded from the low temperature tests that the "Tensilized" Waspaloy bolts of 5/16-inch diameter, 24 threads per inch should be satisfactory for structural applications in space vehicles at temperatures from ambient to -423°F (-253°C).

April 9, 1965 — PRELIMINARY INVESTIGATION OF EXPLOSIVE HAZARDS OF SOLVENTS IN CONTACT WITH LIQUID OXYGEN — IN-P&VE-M-65-3

by C. F. Key and J. B. Gayle

Unclassified, 9 pages, 1 table, 1 figure

Small scale tests were carried out to study the explosive hazards of selected solvents in contact with liquid oxygen. The results indicated that many solvents react explosively with liquid oxygen when suitably initiated. These findings are similar to results of previous studies using nitrogen tetroxide.

June 22, 1965 — S-13 THERMAL CONTROL COATING FOR SA-9/PEGASUS A SPACECRAFT — IN-P&VE-M-65-4

by L. K. Zoller

Unclassified, 15 pages, 5 tables

Optical property data from various tests of the S-13 thermal control coating used on the SA-9 launch vehicle are tabulated. Specimens of the S-13 coating were prepared when the SA-9 vehicle components were painted. These specimens were located in the Launch Complex 37 Service

Tower and, thus, were exposed to the same environmental history as the SA-9 launch vehicle. The specimens were periodically evaluated for ultraviolet radiation stability. The data indicate that the S-13 paint on the SA-9 vehicle was within design requirements and that the paint should not deteriorate beyond prescribed limits due to ultraviolet radiation degradation.

July 22, 1965 — EXAMINATION OF ELECTROPOLISHED FOILS OF ALUMINUM ALLOYS BY TRANSMISSION ELECTRON MICROSCOPY — IN-P&VE-M-65-5

by J. H. Wharton, G. R. Marsh, and W. L. Prince

Unclassified, 22 pages, 12 figures

This report describes the techniques which are involved in electropolishing foils of 7075 aluminum alloy for transmission electron microscopy investigations. The success of these electropolishing techniques is demonstrated by the transmission micrographs that are included. Brief comments concerning the microstructure observed in 7075 aluminum alloy are given.

July 26, 1965 — ABSORPTION CORRECTION TABLES FOR THE PHILIPS AMR/3 ELECTRON PROBE AT ELECTRON ENERGIES OF 30 AND 20 KV — IN-P&VE-M-65-6

by J. H. Wharton, W. L. Prince, and G. R. Marsh

Unclassified, 186 pages, 2 tables

Mass absorption corrections have been tabulated as a function of mass absorption coefficients and atomic number. The corrections are based upon Philibert's simplified expression for F(X) and the use of an emergence angle of 15 degrees. Calculations at two accelerating voltages, 30 KV (Table I) and 20 KV (Table II), are included. A typical application of these data is demonstrated.

December 15, 1965 — LOW TEMPERATURE MECHANICAL PROPERTIES EVALUATION OF TD-NICKEL — IN-P&VE-M-65-7

by C. R. Denaburg

Unclassified, 10 pages, 2 tables, 3 figures

The mechanical properties of annealed TD-Nickel, 0.030-inch thick sheet, furnished by E. I. duPont de Nemours and Company, Incorporated, were determined from ambient temperature through -253°C (-423°F). In

general, the tensile properties increased with a decrease in temperature, and the properties in the longitudinal direction increased slightly more than in the transverse direction at -253°C (-423°F). The notched tensile strength and notched/unnotched tensile ratio in the transverse direction were slightly higher than in the longitudinal direction at all test temperatures.

1965 PUBLICATIONS

by Materials Division

The information in this report has been reviewed for securtiy classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

This document has also been reviewed and approved for technical accuracy.

W. R. Lucas, Chief, Materials Division

F. B. Cline
Director, Propulsion and Vehicle Engineering Laboratory

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